removes water from the solids and creates a filter cake that contains 35 to 50% solids by weight. The filtrate produced by the filter press is recycled to the Concentration Tank. The filter cake is transferred into drums placed beneath the elevated Filter Press. The filter cake sludge is packaged in accordance with WO-4034, Packaging of Solid Radioactive Waste, and WO-1101, Packaging of Solid Radioactive Waste Outside of the Protected Area.

UV/H_2O_2 (Building 891)

The UV/H_2O_2 process oxidizes the organic constituents using 50 percent H_2O_2 - a strong oxidizer - and UV light. The UV light serves to catalyze the oxidation by converting the peroxide to a hydroxyl radical, thus making it a more effective oxidant. Effluent from the UV/H_2O_2 process flows to either the GAC unit or to Surge Tank T-203.

GAC Unit (Building 891)

The GAC unit contains 3000 pounds of granular activated carbon. Water exiting the UV/H_2O_2 oxidation system can be directed to the GAC unit, or can by-pass the system and be sent directly to Surge Tank T-203. During treatment, organic contaminants collect and adhere to the porous carbon surface. Water exiting the GAC system is routed to Surge Tank T-203.

Ion Exchange (Building 891)

Water in Surge Tank T-203 is pumped in series to the first two Ion Exchange (IX) columns (IX Column Nos. 1 and 2). The first column, IX Column No. 1, is provided for removing uranium in the carbonate complex. IX Column No. 1 contains a strong base anion resin in the chloride form (AMBERLITE IRA-900). Although IX Column No. 1 is not regenerated, the column is bump-rinsed once for every five system regeneration cycles. IX Column No. 2 has a weak acid cation resin in hydrogen form (IONAC CC) that removes positively charged cations associated with alkalinity in water. The water flows from IX Column No. 2 to a degasifier where liberated carbon dioxide escapes to the atmosphere. From the degasifier

(sump T-100), the water is pumped to the final two ion exchange columns (IX Column Nos.3 and 4) in series. IX Column No. 3 contains a strong acid cation resin (IONAC C-267) that removes remaining positively charged cations including excess hardness and metals. IX Column No. 4, with weak base anion resin (IONAC AFP-329), is the last unit and removes excess negatively charged anions. The treated water then exits the building and flows to one of the Effluent Storage Tanks (T-205, T-206, T-207).

3.0 SAMPLING APPROACH AND REQUIREMENTS

This section addresses sample locations, frequency, specific analytical needs, sampling requirements, and associated quality assurance/quality control (QA/QC) requirements. Data collection follows requirements outlined in the Rocky Mountain Remediation Services, L.L.C. Quality Assurance Program Description (QAPD), RMRS-QAPD-001, Rev. 1, 1/01/97. Refer to Section 5.0 of this document for a discussion on the Data Quality Objectives (DQO's) for the CWTF samples.

3.1 SAMPLING LOCATIONS AND FREQUENCY

Provisions are made for sample collection at specific points in the collection and treatment system to evaluate influent and effluent characteristics, unit process effectiveness, and waste stream characteristics. The placement of sampling locations allows each treatment unit to be isolated if evaluation of individual unit efficiency is required. Samples collected from 891COLGAL and 891COLWEL will follow the sampling protocol outlined in the OU1 ROD.

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The following is a list of sampling locations and associated Soil and Water Database (SWD) location codes:

- Routinely Sampled Sources (samples are taken quarterly)
  - Collection Gallery(French Drain Sump) · 891COLGAL
  - Collection Well 891COLWEL
  - OU2 Weir 059 SW059
  - OU2 Weir 061 SW061
  - OU2 Weir 132 SW132

TABLE 3-5

Sampling Summary - Process Waste and Spent Media

RFEDS Location Code	Sample Location	Sample Type	Sampling Frequency[1]	Analytical Suites	Analytical Methods/Protocol Used
891SCA[5]	Spent Clay Absorbent	Solid	Grab samples as requested	Metals[6],SVOCs[6], VOCs[6], Radionuclides[3]	EPA 1311 TCLP: VOCs Method 8260, SVOCs Method 8270, Metals 6010 and 7000s Methods. Radiochemistry. Optional: PCBs
RS8[5]	Filter Press Solids Cake	Solid	Grab samples as requested	Metals[6], SVOCs[6], VOCs[6] Radionuclides[3]	EPA 1311 TCLP: VOCs Method 8260, SVOCs Method 8270, Metals 6010 and 7000s Methods. Radiochemistry. Optional: PCBs
RS10 RS11	Spent Cleaning Tank Solution Spent Flush Tank Solution	Aqueous	Grab samples as requested	Optional: Metals, pH, Radionuclides[3]	Metals TCL[2], pH Level II, Radiochemistry
RS9[5]	Spent GAC (Liquid-Phase) 891 GAC Unit	Solid	Grab samples as requested - samples from top 6" from unit bed after removing from service	Metals[6], SVOCs[6], VOCs[6] Radionuclides[3]	EPA 1311 TCLP: VOCs Method 8260, SVOCs Method 8270, Metals 6010 and 7000s Methods. Radiochemistry Optional: PCBs
891REGTANK	IX Regeneration Neutralization Tank T-210, HVC-210	Aqueous	Grab samples as requested prior to transfer to Building 374	Radionuclides, pH	Gross Alpha/Beta Level II (Rad Screen), pH Level II, Optional every 30 transfers: VOCs EPA 8260, Total Metals TCL[2], Radionuclides[3]
891SGACV[5] 891SGACV[5] 891SGACV[5]	Spent GAC (Vapor-Phase) Influent Tank T-200, Drum-1 T-900A, Drum-2 T-900B, Drum-3	Solid	Grab samples as requested	VOCs[6], Radionuclides	Total VOCs EPA Method 8260, Radionuclides[3]
891VESIX1[5] 891VESIX2[5] 891VESIX3[5] 891VESIX4[5]	Spent Ion Exchange Resin: IX #1 IX #2 IX #3 IX #4	Solid	Grab samples as requested	VOCs[6], Radionuclides	Total VOCs EPA Method 8260, Radionuclides[3]

3.2 ANALYTICAL METHODS

Tables 3-1 through 3-5 also summarize the sampling locations, sampling frequencies, analytical suites, and analytical methods for the anticipated contaminants of concern. EPA's CLP protocols are considered Level IV analytical methods. The analytical methods are described in Test Methods for the Evaluation of Solid Waste, EPA SW-846, Methods for the Determination of Organic Compounds in Drinking Water, Standard Methods for the Examination of Water and Wastewater, and Methods for Chemical Analysis of Water and Wastes. Radionuclides are analyzed by methods developed by or reviewed and approved by the EPA. The methods proposed for sample analysis are those recommended by the EPA and are deemed consistent with the data quality objectives (DQOs). In addition, the Rocky Flats Statement of Work for Analytical Measurements, 1997 analytical specific QA/QC requirements will be used.

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The analytical accuracy and precision goals are presented in the respective methods. These criteria include surrogate recoveries, matrix spike recoveries, matrix spike duplicate or laboratory duplicate precision, calibration linearity, laboratory control sample analyses, etc. Refer to the CLP protocols, the analytical methods, and the Rocky Flats Statement of Work for Analytical Measurements for an exact description of the QA/QC measures and acceptance ranges for each method.

3.3 BOTTLE AND PRESERVATION REQUIREMENTS

Tables 3-6 and 3-7 show the bottle and preservation requirements, storage temperature requirements, and maximum holding time for the aqueous and solid samples listed in Tables 3-1 through 3-5.

3.4 FIELD QUALITY CONTROL

Field QC samples will be included to assure the accuracy and precision of the sampling procedures. Field sampling quality control will consist of the following:

- Collection of field duplicate samples will be at a minimum of 1 per 20 discharge or influent samples;
- Collection of sampling equipment rinsate blanks at a minimum of 1 per 20 discharge or influent samples (as appropriate);
- Collection of a trip blank (volatile organic compounds only) at a minimum of 1 per discharge or influent source sample shipment.

4.0 SAMPLING PROCEDURES

This section discusses the methods for collecting, management, screening, packaging, and shipping CWTF samples.

4.1 SAMPLE COLLECTION

A stainless steel beaker is used to collect SW059, SW061, and SW132 surface water samples and the 881 Footing Drain water in accordance with 5-21000-OPS-SW.03, Surface Water Sampling. Sample ports with attached tubing are used to collect samples from the French Drain Sump and the Collection Well. This tubing is removed after each sampling event. The CWTF aqueous hand sample ports are also equipped with attached tubing. The T-210 regenerant is neutralized according to 4-I55-ENV-OPS-FO.37, Rev.1, Neutralization Tank Normal Operations, CWTF, and is sampled after the tank is full. Filter press cake is sampled as it is removed from the Filter Press and placed in drums in accordance with 4-I61-ENV-OPS-FO.43, Rev. 1, Filter Press Operation and Cleaning, CWTF. Liquid and vapor phase GAC, and IX Resin will be sampled when it is determined that the GAC or resin is spent.

When collecting CWTF process water samples, it is important that the particular unit process being sampled has been in operation for an appropriate period of time to ensure that the water contents of the

unit have been purged. This will ensure that the sample is representative of the process conditions at the time of sampling.

In addition to ensuring that a particular unit process has been purged prior to sampling, it is also important to ensure that the sample port is purged prior to sample collection. The purge time for the UV, GAC, Precipitation/Microfiltration and IX sample ports is 30 seconds. Purge time for the French Drain Sump and the Collection Well is 3 minutes.

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The field data collected on the CWTF influent and discharge samples will include pH, conductivity, and temperature. The temperature will be monitored using a thermometer or temperature recording instrument which has been calibrated against a NIST traceable standard thermometer. Neither residual chlorine checks nor tap preparation for bacteriological samples is required for any of the samples collected under this sampling plan. Flow measurements will not be performed on the surface water sample locations. It is not necessary to follow a particular bottle order when collecting the samples.

When collecting water samples, do not touch the water as it enters the bottle and do not touch the inside of the bottle or cap. If either of these occur, discard the bottle, obtain a new one and collect a new sample. Purge water drained from the treatment system during sampling should be returned to the treatment system. Plastic sheeting used during sampling should be disposed of as specified in the Waste Stream and Residue Identification and Characterization (WSRIC) for the CWTF. Spills will be collected and handled in accordance with Section 4 of the Hazardous Waste Requirements Manual (EG&G, 1994). Personal protective equipment will be removed and handled as outlined in SOP 5-21000-OPS-FO.06, Handling of Personal Protective Equipment, and Section 4.6 of this document, Personal Protective Equipment. All procedures shall be in accordance of the CWTF Health and Safety Plan (RF/ER-96-0118).

Due to time constraints during sampling, the samples will be placed in a cooler with blue ice (if required) and transferred to the laboratory or sample refrigerator as soon as possible to chill the samples to $4^{o}C \pm 2^{o}C$. It is recognized that the cooler and samples will not achieve $4^{o}C \pm 2^{o}C$ in the field. Because monitoring of the cooler/sample field temperature requires that the cooler be opened multiple times, which would result in a rise in the internal cooler temperature, the field temperature of the cooler/samples will not be monitored. Radiological samples do not require refrigeration but must be secured in a cool, dry area to minimize the chance of cross-contamination.

4.2 SAMPLE CUSTODY

The chain of custody for sampling shall be filled out in accordance with 5-21000-OPS-FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples, and 4-B29-WR-OPS-FO.14, Field Data Management. Custody seals shall be placed on the sample containers after the samples are collected and prior to being relinquished from the sampler. The names of the samplers must be printed on the form. The samples will be kept under custody until both the COC and samples are relinquished for shipping. The COC is signed when samples are relinquished for analysis.

4.3 SAMPLE EQUIPMENT DECONTAMINATION

Equipment used at more than one location for collection of CWTF samples shall be decontaminated between sampling locations in the field, laboratory, or at the Decontamination Facility in accordance with 5-21000-OPS-FO.03, General Equipment Decontamination. Equipment decontamination is recorded in the facility logbook if the procedure is performed at the Decontamination Facility. Water used for equipment decontamination will be treated at the CWTF.

4.4 RADIOLOGICAL SCREENING OF SAMPLES

The radiological screening of samples in preparation for off-site shipment will comply with 5-21000-OPS-FO.18, Environmental Sample Radioactivity Content Screening. Environmental samples are considered

non-radioactive (DOT Category I) if sample screening indicates a total activity less than 2,000 pCi/g for solids, or less than 2,000 pCi/mL for waters and have a gross alpha activity of <10,000 pCi/sample and gross beta activity of <100,000 pCi/sample.

In the event that samples are above 2,000 pCi/g(solids) or 2,000 pCi/mL (aqueous) for radioactivity, 4-B11-ER-OPS-FO.25, Shipment of Radioactive Materials Samples, will be used for sample shipment.

4.5 SAMPLE STORAGE, PACKAGING AND SHIPPING

When sampling is complete (refer to Section 4.1 for sample collection details), the samples must be properly packaged and stored until they are shipped in accordance with 5-21000-OPS-FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples as applicable. The sampler/packer shall use best judgment when packing samples. Delivery of samples to the on-site lab will not require the stringent packaging requirements applicable to off-site shipments. If samples are to be shipped off-site, the samples should be stored until results are received from the Radiological Screen samples (refer to Section 4.4 of this document) if applicable. Radiological samples do not require refrigeration but must be secured in a cool, dry area to minimize the chance of cross-contamination.

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Samples which are collected and stored prior to shipment will be placed in the field refrigerator to $4^{o}C \pm 2^{o}C$. When in use the temperature of the field refrigerator is monitored. The samples are packaged with blue ice in a cooler and shipped to the laboratory. Cooler temperatures will be checked upon arrival at the laboratory.

Samples which are collected and shipped off-site during the same working day are packaged with blue ice to cool the samples as much as possible during shipment to the laboratory. Cooler temperatures will be checked upon arrival at the laboratory, but it is possible that the samples will achieve temperatures of $4^{o}C \pm 2^{o}C$ only after being placed in the receiving laboratory refrigerator.

Rocky Flats Statement of Work for Analytical Measurements, 1997 since these methods and associated QA/QC protocols are generally considered industry standards for producing accurate and precise data.

Volatile organic trip blank samples provide a measure of contamination that has been introduced into a sample set during sample collection or shipping.

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Field duplicated samples (at a minimum of 1 per 20 samples) and sampling equipment rinsate blanks (at a minimum of 1 per 20 as appropriate) will be taken to ensure sample quality. A comparison between real and duplicate samples must meet a Duplicate Error Ratio (DER) of 1.42 or less for radiological samples, and a 30% Relative Percent Difference (RPD) for organic samples. The RPD limits must be met for all samples with results greater than five times the reporting limit. The equation for DER calculation is as follows:

$$DER = \frac{|S - D|}{2 * \sqrt{\sigma^2_S + \sigma^2_D}}$$

Where σ_S = Total propagated uncertainty of the sample
σ_D = Total propagated uncertainty of the duplicate
S = Sample Activity
D = Duplicate Activity

Precision and accuracy objectives are evaluated on the basis of the detection limits specified in the referenced analytical method and/or data validation guidelines. For radionuclide analyses, the accuracy objectives specified in the Rocky Flats Statement of Work for Analytical Measurements, 1997 methods and data evaluation protocols will be followed. Effluent samples will be validated at 100% and all other samples will be validated at 25%.

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition.

Representativeness is a qualitative parameter that emphasizes the proper design of the sampling program.

A completeness goal of 90% is expected for the CWTF data; that is, for each sample taken and each analysis performed during the CWTF sampling activities, the usable data points will be at least 90% of the theoretical amount of data points.

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared with another. To achieve comparability, CWTF sampling will follow the approved SAP, which includes the use of standardized analytical protocols, data collection following 5-21000-PS-FO.13, Containerization, Preserving, Handling and Shipping of Soil and Water Samples, and report data in consistent units of measurement.

6.0 DATA MANAGEMENT

Each CWTF sample point is assigned a unique Soil and Water Database (SWD) location code, and this unique code will be utilized on the COC form, applicable SWD forms, and during input to and retrieval from the SWD. The SWD location codes utilized at the CWTF are detailed in Section 2.0.

Field observations for influent and effluent water samples will include pH, conductivity, and sample temperature, will be determined in the field, and will be recorded on the Field Measurement Log Sheet, Soil and Water Database Form. Extraneous field parameters (e.g., stream width, total depth, salinity, saturation, dissolved oxygen, chlorine, total alkalinity, etc.) will not be taken. Field observations for sediment samples will include, depth and collection method and will be recorded on the Field Measurement Log Sheet, Soil and Water Database Form.

A sample chain of custody (COC) will be initiated for collected CWTF samples. The COC shall be maintained through sample storage and through all transfers of custody until the sample is received at the testing laboratory. COCs are archived for defensibility of the analytical and sampling data. Samples shall be logged in upon receipt at the analytical laboratory and sample tracking throughout the analytical process shall be maintained in accordance with laboratory procedures. 5-21000-OPS-FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples and 4-B29-WR-OPS-FO.14, Field Data Management will be followed during sampling activities.

Results from the radiological screen will be sent to the Responsible Manager. Other results will be submitted to SWD to track, store, and retrieve project data. The sample collection information submitted to SWD will include sample number, volume collected or volume of container, sampler's name, sampling date, analysis parameter, and COC number in accordance with SOP FO.14, Field Data Management.

7.0 ANALYTICAL RESULTS EVALUATION

7.1 CONTROL OF NONCONFORMANCES

The requirements for the identification, control evaluation, and disposition of nonconforming items, samples, and data will be implemented as specified in Section 15.0 of the RMRS QAPD, as applicable.

7.2 USE OF ANALYTICAL RESULTS

The water samples will be evaluated for discharge-related constituents to determine if effluent waste water treatment standards are achieved. Solid samples will be evaluated for RCRA-regulated constituents to ensure that each constituent meets waste disposal criteria. Analytical results for solid sampling will be recorded by Project Management personnel on the following forms for wastes disposed at ENVIROCARE, per instructions outlined in Chapter IV of the Material Acceptance Process Manual prior to receiving approval for shipment:

- Radioactive Waste Shipment & Disposal Record (Form #E 100)
- Mixed Waste Profile (EC-0175)
- Physical Properties Evaluation (EC-0500)
- Radiological Evaluation Form (EC-0650)
- Uniform Hazardous Waste Manifest (8700-22)
- Land Disposal Restriction (LDR) Notice and/or Certification
- Weigh Bill

If effluent wastewater meets treatment standards (see Appendix A), the water may be discharged in accordance with Standard Operating Procedures. Normally, exceedences in effluent wastewater treatment standards will be handled through retreatment and resampling. Under certain circumstances, water with minor exceedences may be evaluated for discharge subject to approval with CDPHE, USEPA, and DOE.

8.0 DATA QUALITY OBJECTIVES FOR OFF-SITE DISPOSAL

This section addresses only filter press cake because spent GAC, spent IX Resin, and spent clay absorbent are analyzed as each drum/batch is spent, and neutralized regenerant is analyzed when T-210 is full.

Normally several drums of filter press cake are generated during each filter press run. The primary objectives of filter press cake sampling is to obtain defensible data that can be used to determine whether the physical and chemical properties of the waste comply with off-site (or on-site) waste disposal criteria as appropriate (for an example of off-site waste disposal criteria refer to the Material Acceptance Process Manual developed by ENVIROCARE). Additional information relating to the data quality objectives of the WSRIC program is presented in the WSRIC Program Description.

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8.1 DECISION RULE

Filter Cake is a F-listed waste, but is not expected to exhibit hazardous characteristics (reactivity, ignitability, corrosivity, or toxicity). The solids will meet LDR requirements if the analytical results demonstrate that the hazardous constituents are below treatment standards listed in 6 CCR 1007-3, Part 268.

8.2 DECISION DATA

Analytical data will be used to determine if the filter cake meets LDR treatment standards. Drums of filter cake will be sampled as follows:

- One grab sample for VOCs and SVOCs
- One grab sample for metals and rads

If these analytical results are below the regulatory limits with 90 percent confidence, the solids can be shown to meet LDR treatment standards.

8.3 DECISION DOMAIN

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The spatial domain for this waste form is comprised of CWTF filter cake sludge generated during the treatment of environmental wastewater from Interim Measure/Interim Remedial Actions (IM/IRA) activities or Environmental Restoration (ER) Accelerated Action Project Waters.

8.4 DECISION DATA QUALITY OBJECTIVES

The WSRIC Program Description lists the control criteria for the analytical methods that will be used on the samples. These criteria ensure that listed limits for analytical precision, accuracy, reproducibility, and bias are not exceeded.

9.0 RECORDS

The following documents generated during the perfromance of this procedure must be controlled as follows:

Document	Record Type	Disposition
Document History File	QA, Non-Permanent	Records Management transmits to RMRS Records Center, where retained for 12 months after procedure is superseded or canceled. RMRS Records Center staff then formally transmits to the Site Records Management organization for long term storage on accordance with the provisions of 1-77000-RM-001, Records Management Guidance for Records Sources.
Draft Versions of Document as Submitted for Review, and Peer Reviews	Non-QA	Records Management retains until procedure is approved, at which time the Draft versions may be discarded.